

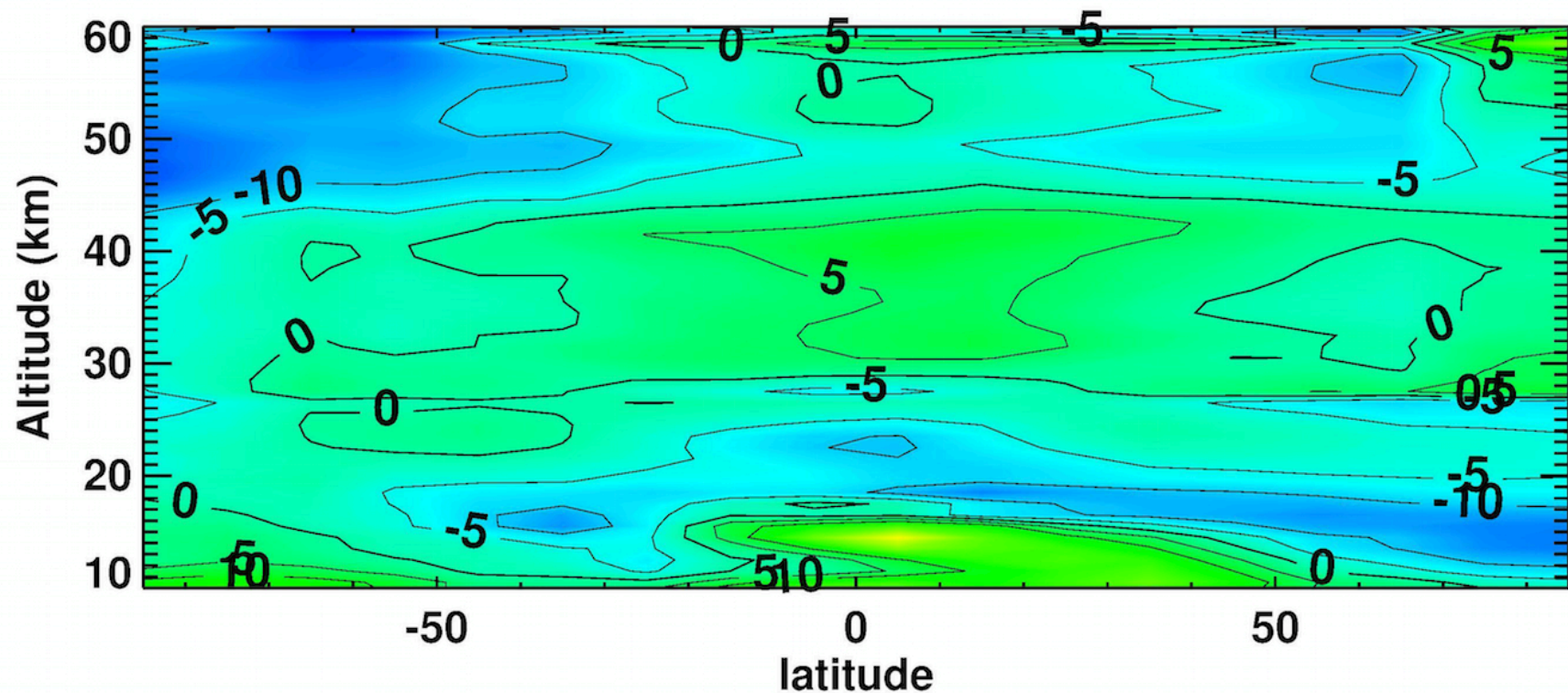
OMPS LP Status Report

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O₃ Product Status

- V2 data released in summer 2014.
- Data can be used for scientific studies despite some bias issues.
 - Seasonal and short-term variabilities agree very well with MLS & ACE-FTS.
 - Current plan is to write a paper comparing V2 data with V4.5 MLS, ACE-FTS, sondes etc., identifying known errors and their impact.
- We have decided not to proceed with V2.5
 - Straylight error in VIS is too large and there are significant disagreements between the slits.
 - Need resources to produce a reliable aerosol product, do better cloud detection, and to fix known errors in GMAO p(z) profiles. All are essential to produce good ozone.

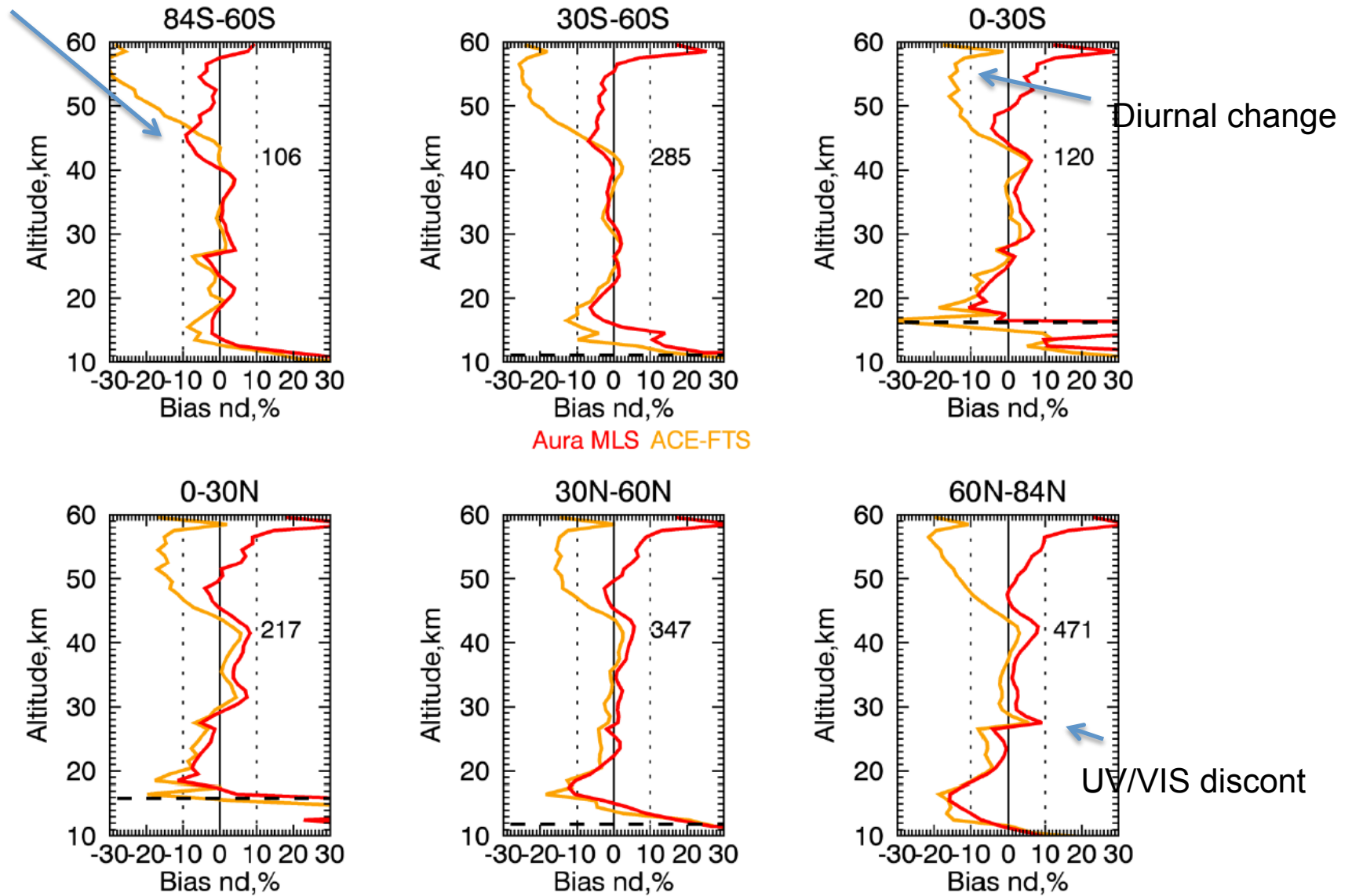
LP/MLS Bias (%) in V2



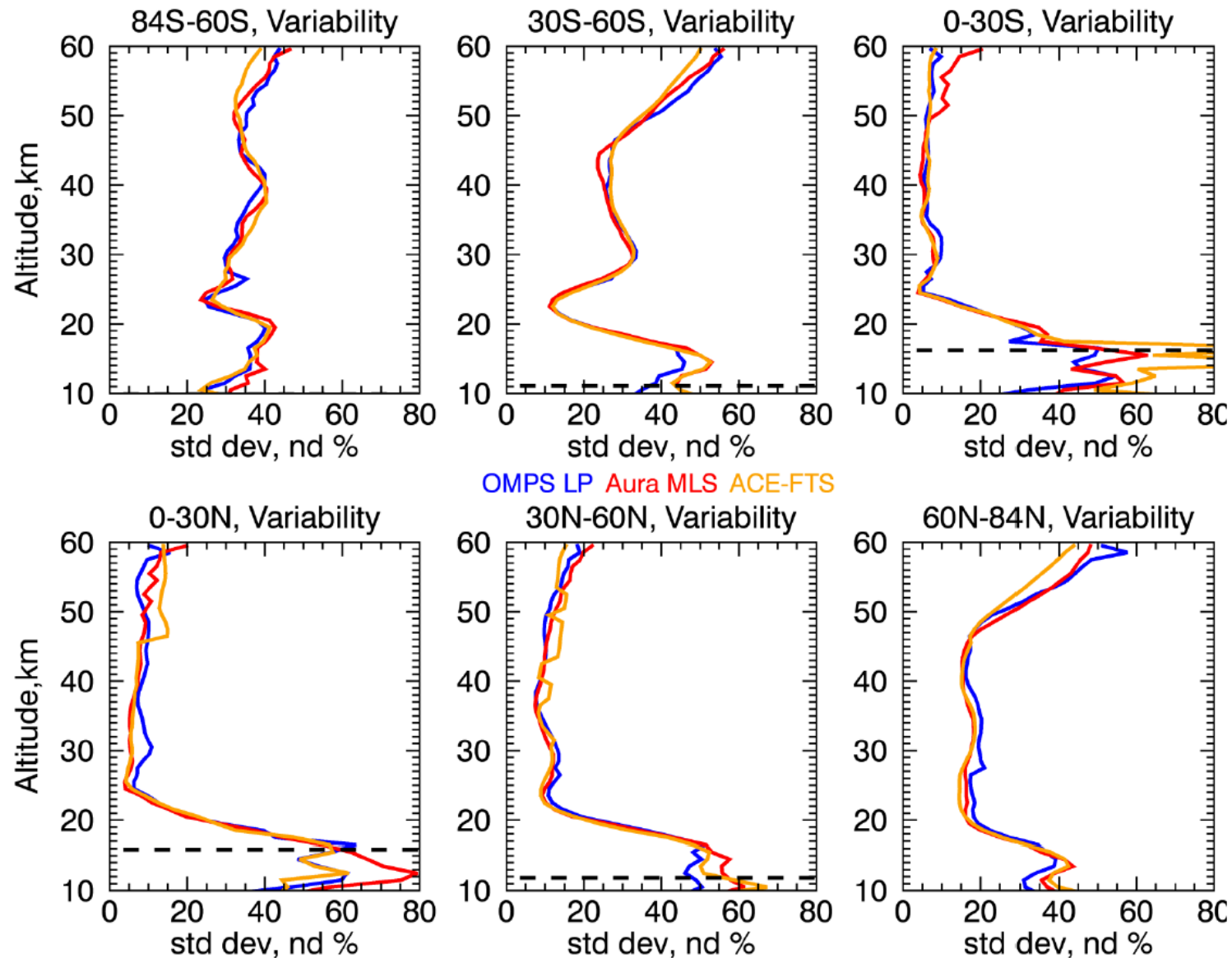
Mesospheric biases are probably due to error in MLS GPH which was used for these comparisons. Biases in lower stratosphere are due to aerosol-caused errors in LP. Bias in upper trop may be MLS error.

LP/MLS/ACE-FTS biases

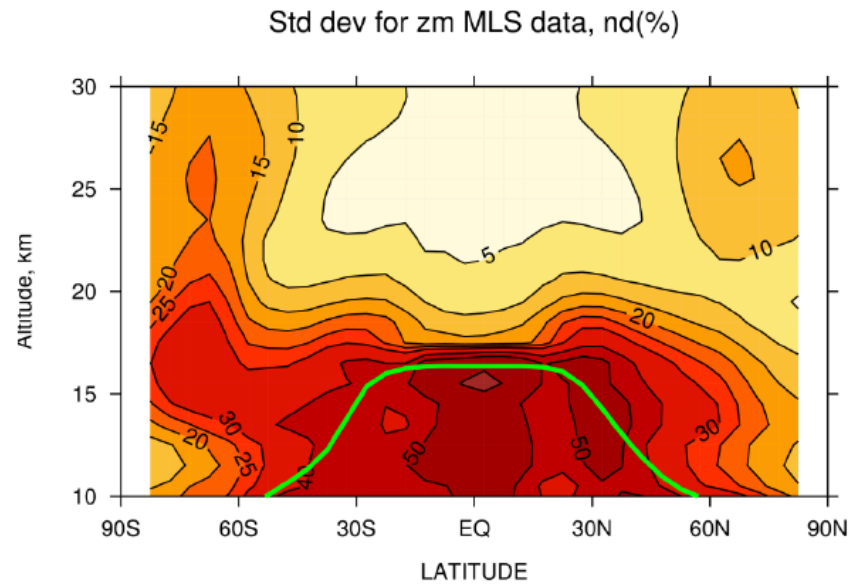
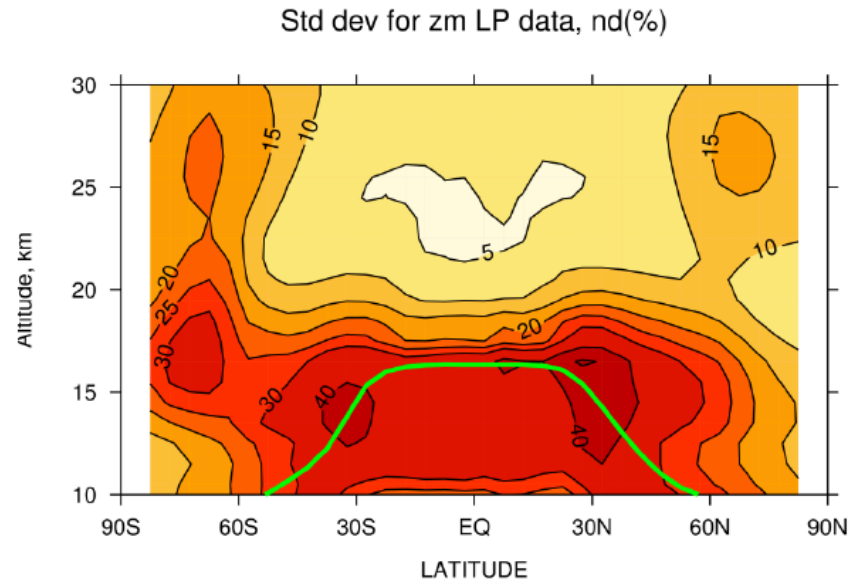
No bias against ACE



Comparison of LP/MLS/Ace-FTS Variability



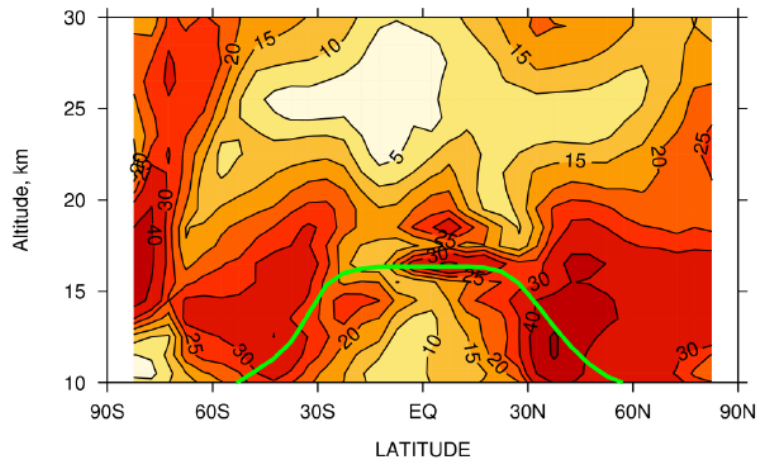
Comparison of LP/MLS var at lower altitudes



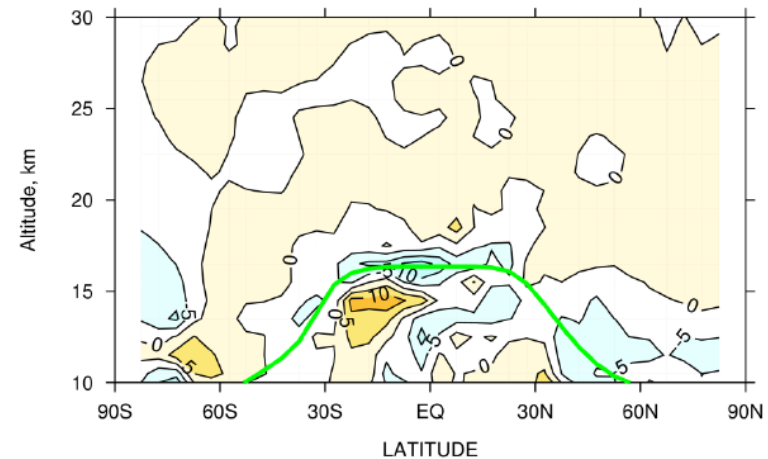
Comparison of LP/MLS Seasonal Var

OMPS LP vs Aura MLS

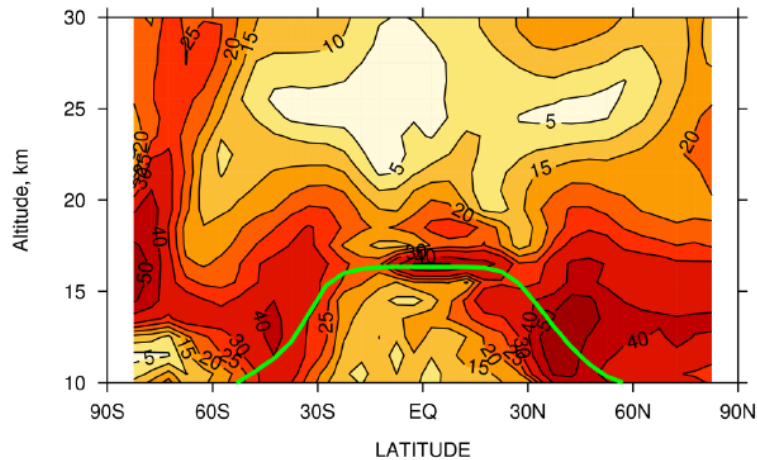
Amplitude of the Seasonal cycle LP, nd(%)



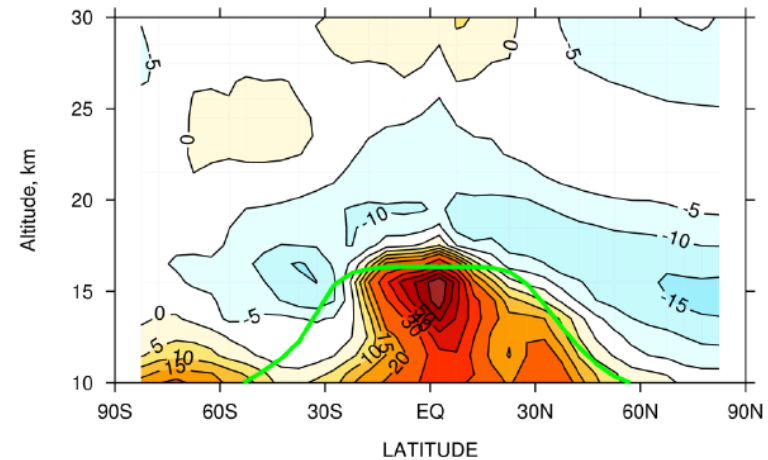
Differences in amplitude of SC, LP-MLS, (%)



Amplitude of the Seasonal cycle MLS, nd(%)



Mean Differences, LP-MLS(%)



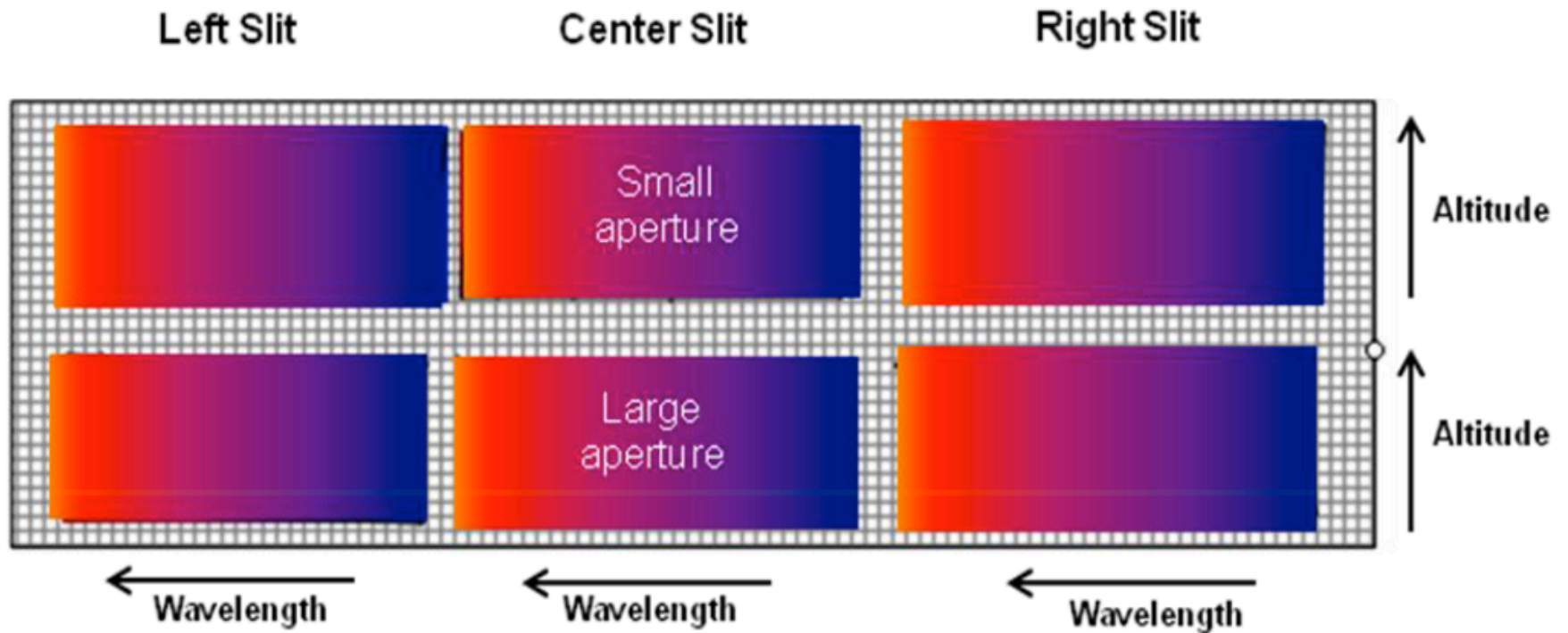
Known Reasons for the Biases

- Altitude registration errors
- Aerosol Effects
 - Pairs and triplets used in the O_3 algorithm provide good 1st order correction, but there are 2nd order effects.

Sources of Altitude Registration Errors

- Error in relative alignment between OMPS-LP and SNPP star tracker.
- Relative alignment errors between 6 OMPS-LP slits.
- Flexing of S/C bus at OMPS location wrt to star tracker.
- Distortion of LP focal plane due to thermal effects.

LP Focal Plan Schematic



Altitude Registration Methods

- Focal Plane Image analysis
 - Can detect internal misalignment and thermal shifts but not S/C errors.
- I(35km)/I(20km) @ 350 nm (aka RSAS)
 - Provides absolute TH error with 100 m accuracy.
 - Works best in the south polar vortex (Sep/Oct), too much aerosol contamination elsewhere.
- 305 nm/ 60 km radiance analysis
 - Provides intra-orbit/seasonal variations in TH error with ~50 m precision.





Altitude Registration Errors (updated slide from Glen Jaross)



350 nm Scene-based offsets (arcmin)

	East	Center	West
Small	1.00	1.40	1.70
Large	1.75	1.85	2.45

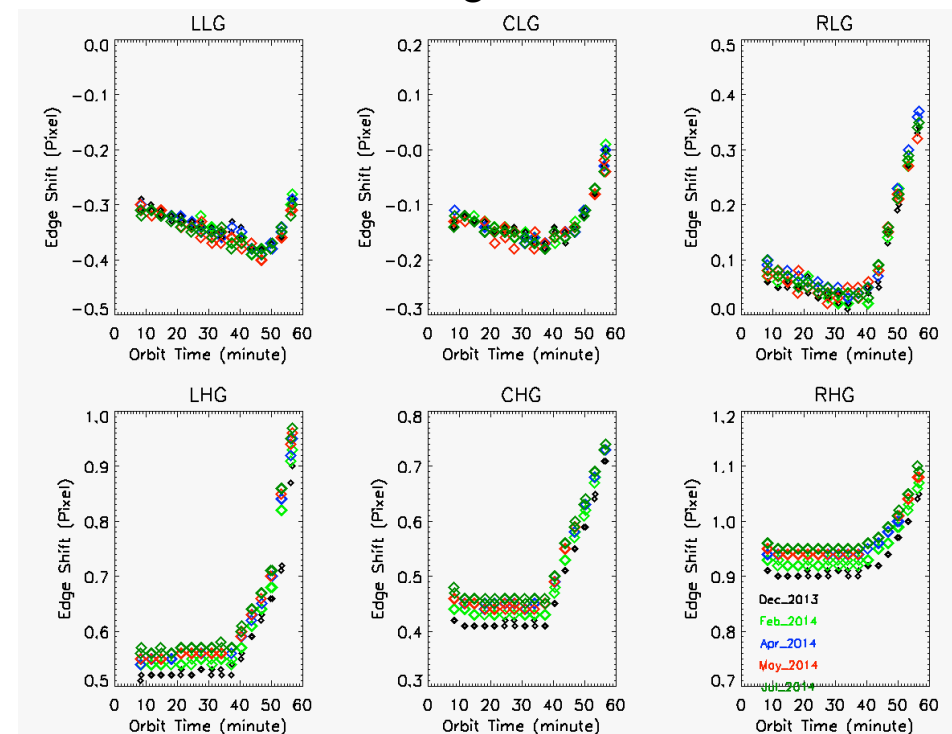
Slit Edge offsets (arcmin)

	East	Center	West
Small	-0.30	-0.10	0.10
Large	0.55	0.45	0.95

Residual offsets (arcmin)

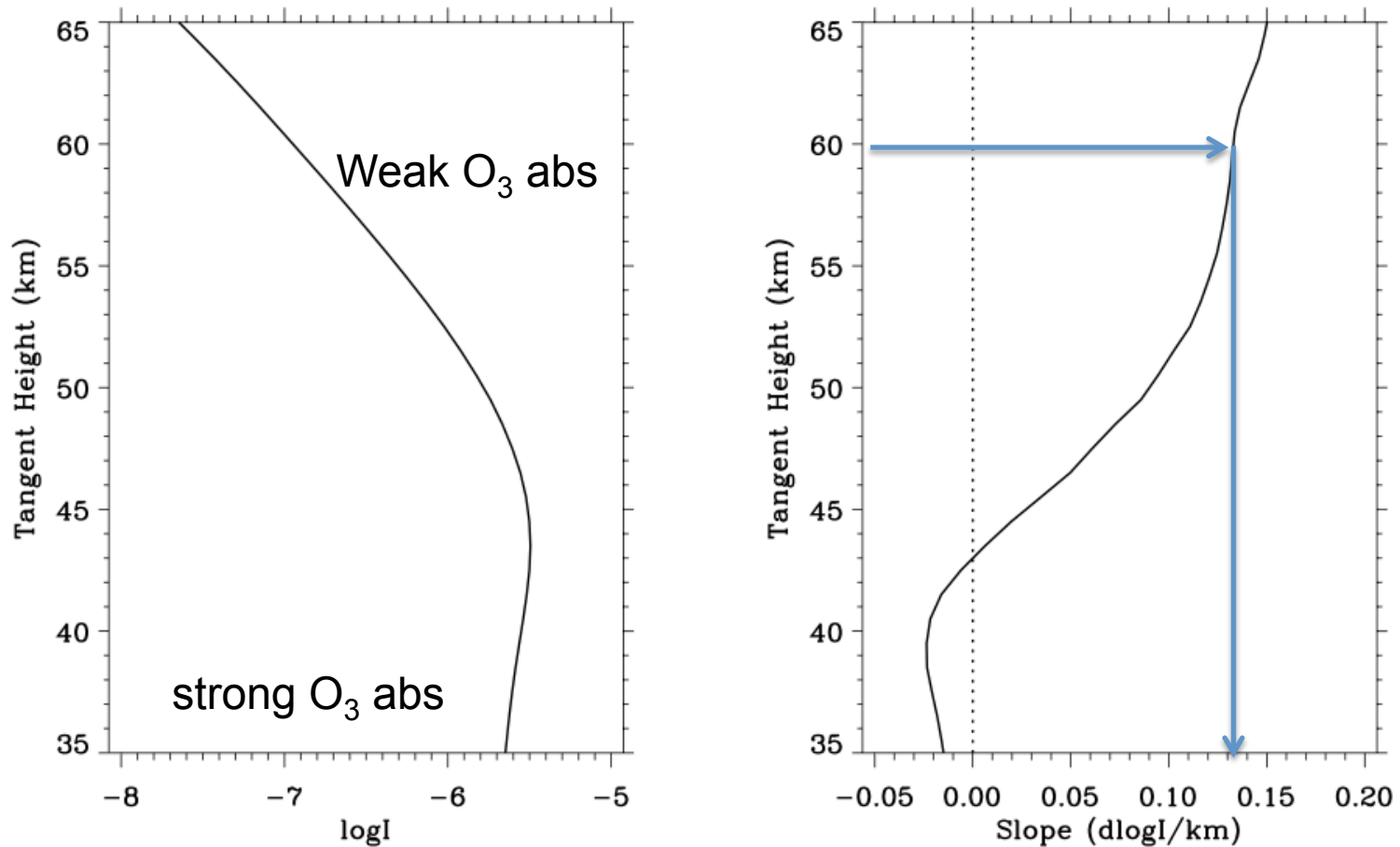
	East	Center	West
Small	1.30	1.50	1.60
Large	1.20	1.40	1.50

Slit Edge Shifts



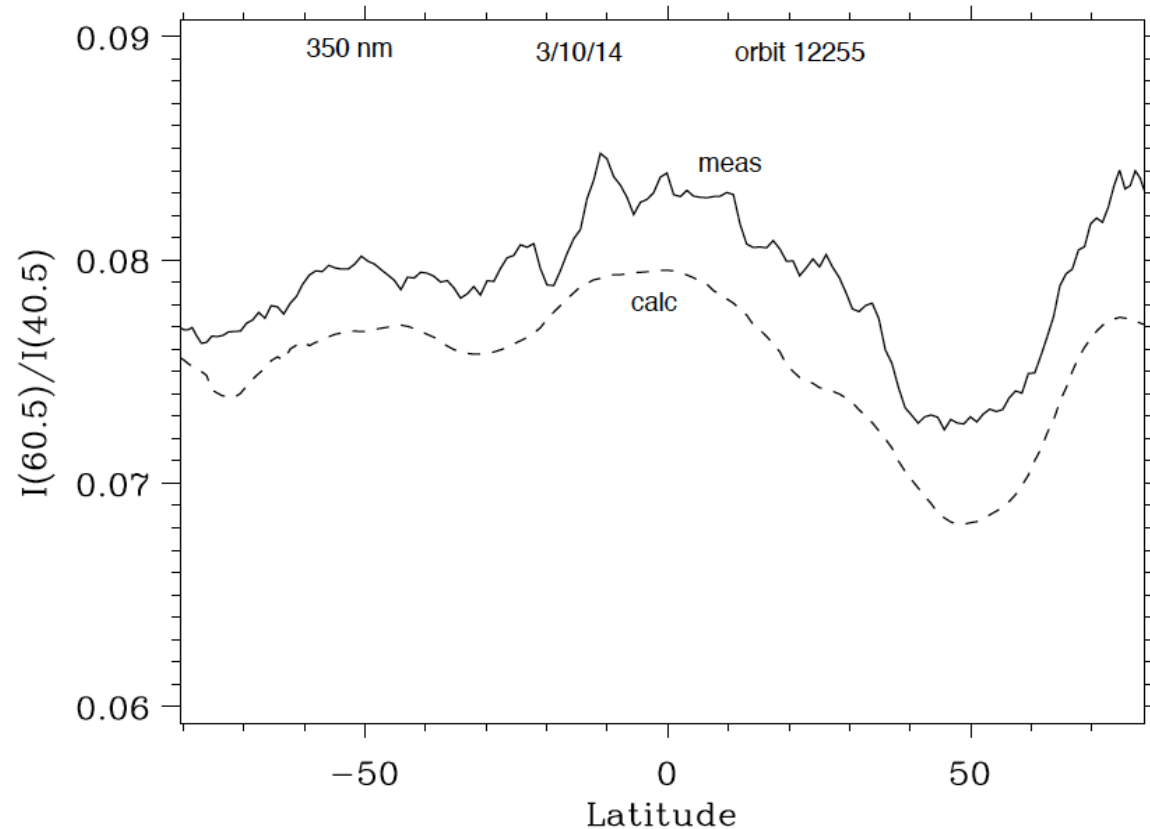
Mean = 85 arcsec

Alt Registration using 305 nm



60 km radiance varies by 13%/km and is insensitive to O₃. But to estimate TH error one needs accurate $P(z)$ profiles near 60 km.

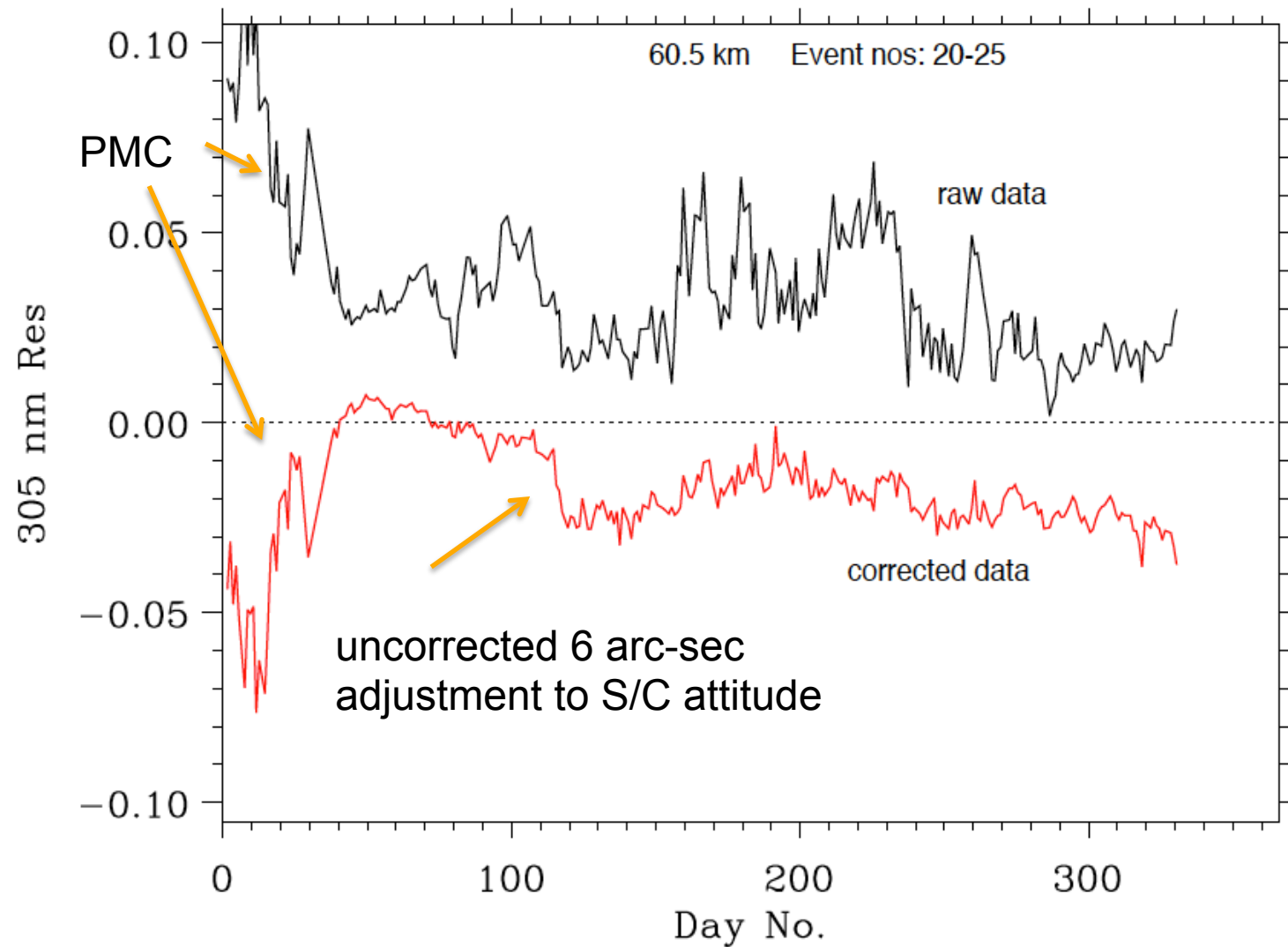
Assessment of GMAO pressure @ 60 km using LP



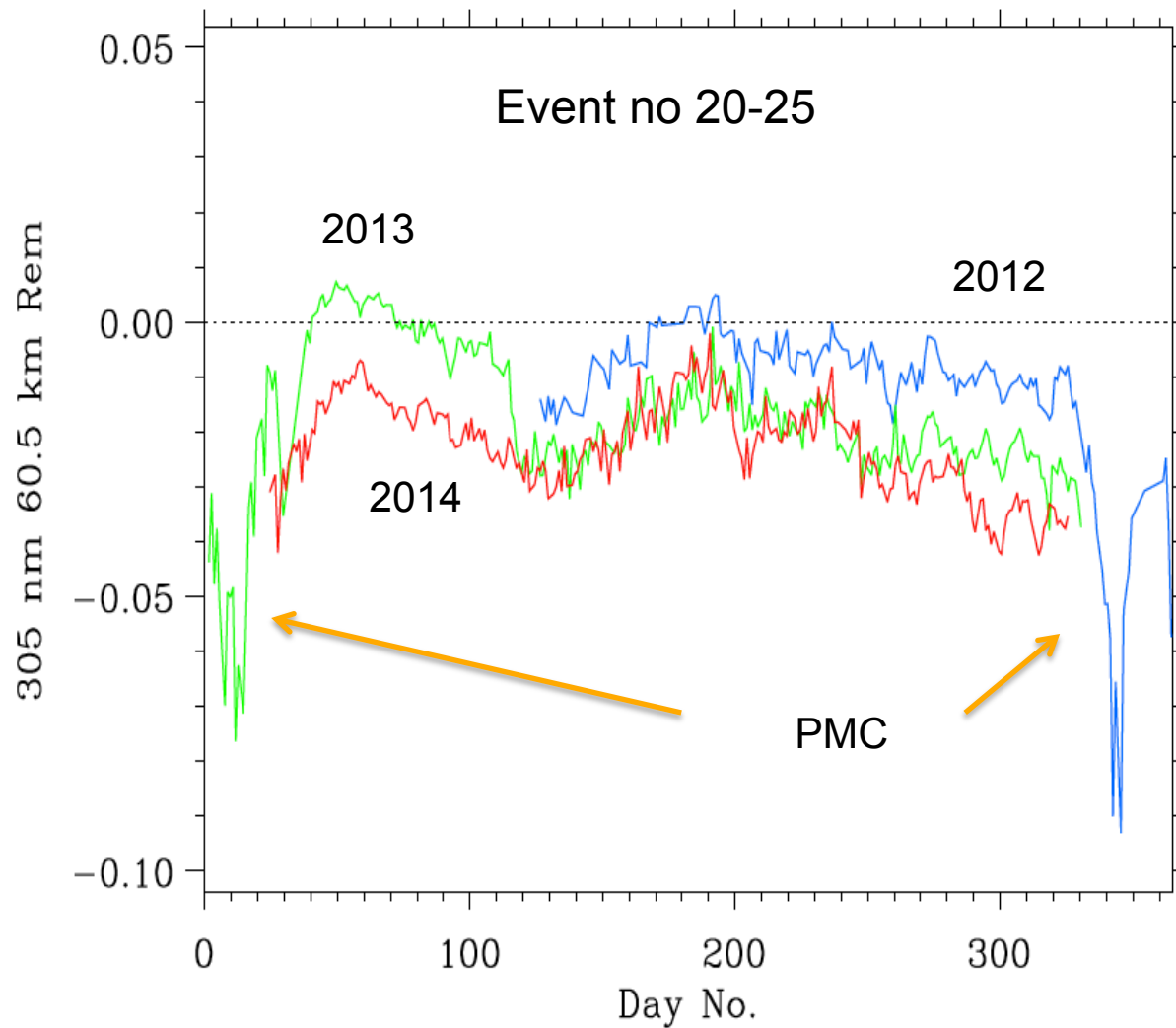
Bias between meas & calc is likely due to error in GMAO temperature between 40 and 60 km. Since MLS & GMAO agree well at these altitudes, they both appear to have similar errors.



305 nm 60.5 km residuals



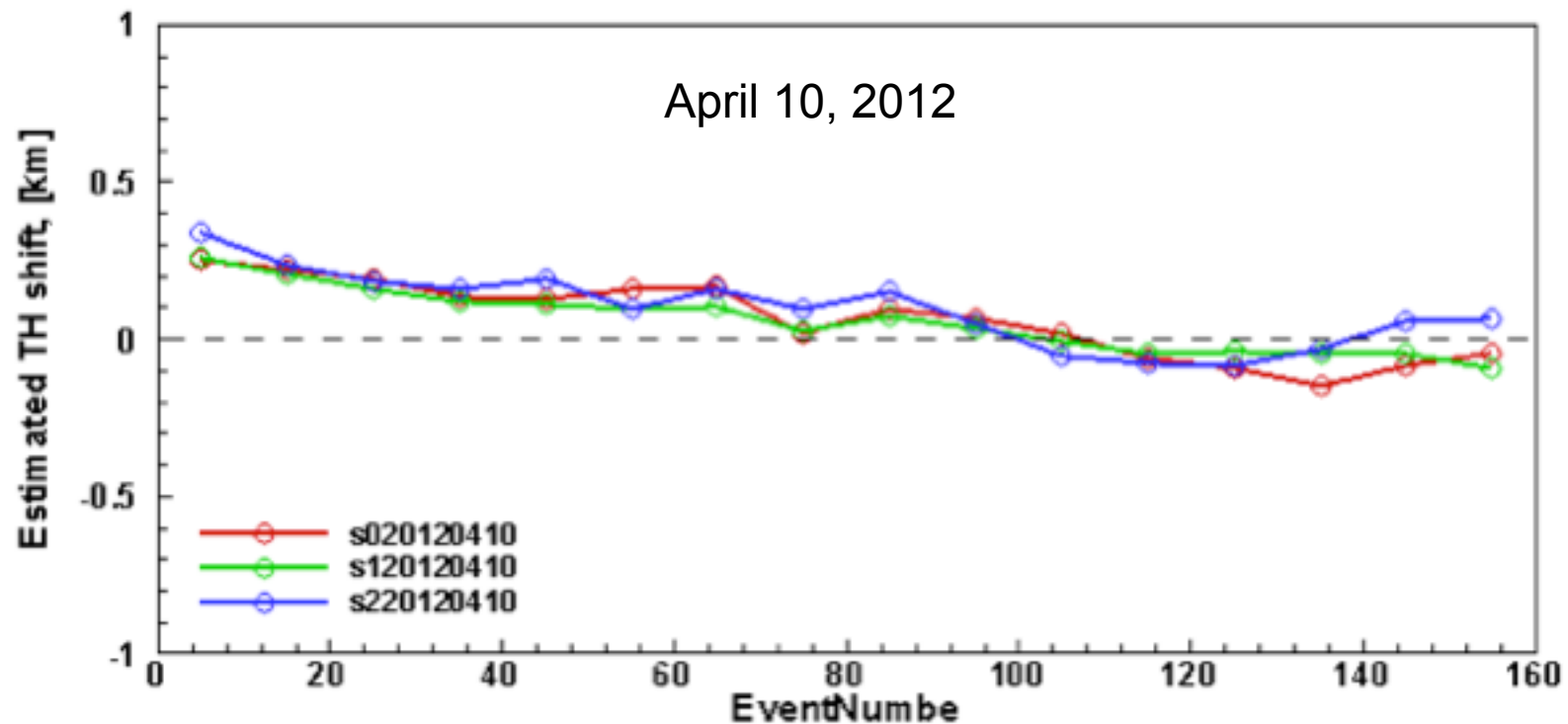
305 nm multi-year corrected residuals



Are the seasonal variations due to TH error or error in GMAO GPH?



Along-orbit variation in TH error (after inter-slit altitude bias corrn)

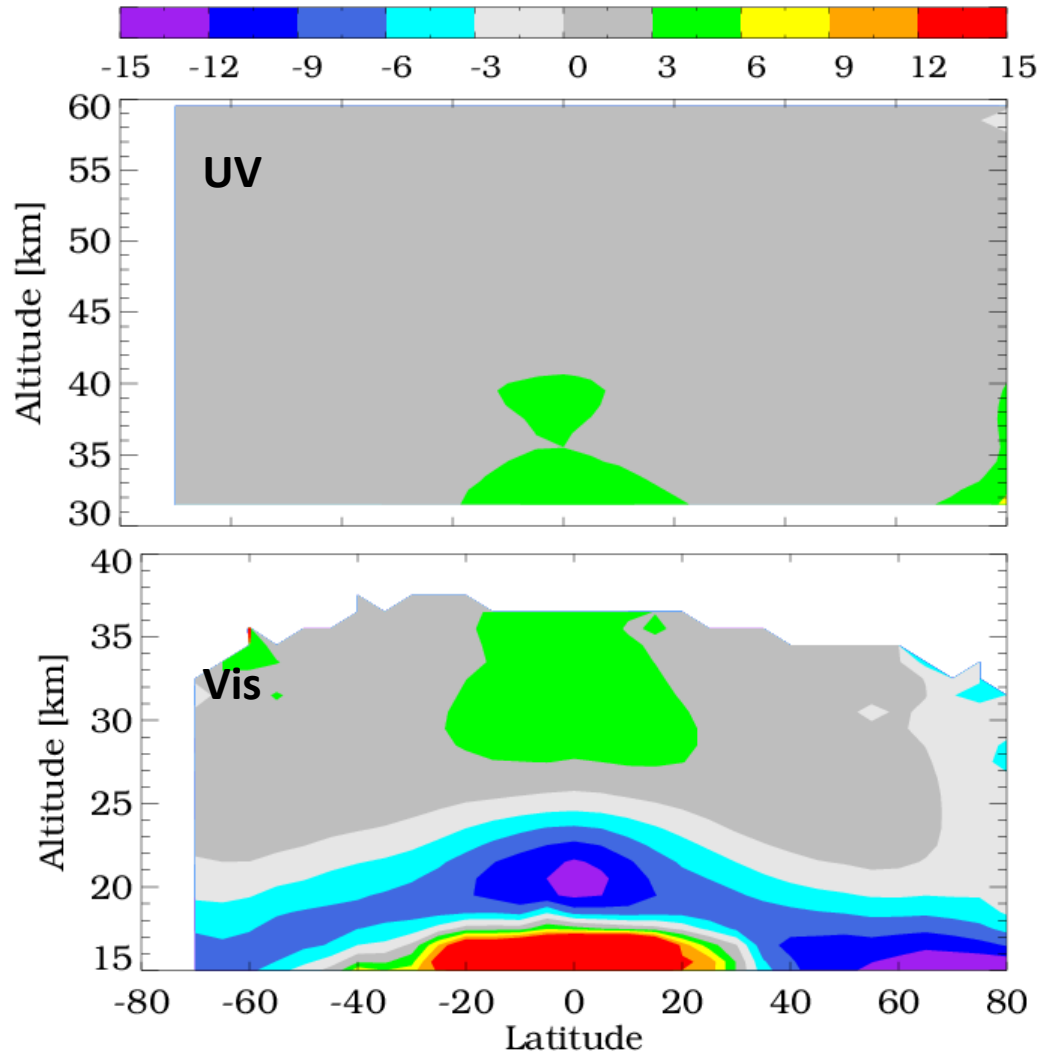


Summary

- We have developed three excellent methods of tracking altitude registration errors.
 - These methods have identified 85 ± 6 arc-sec pitch error and 120 ± 40 arc-sec roll error in S/C attitude. They are also showing shifts in S/C attitude of few arc-sec that are not provided on O/A files, but have been confirmed by the SOC.
 - The method has ~ 100 m uncertainty, mostly caused by errors in GMAO GPH data @ 40 km.
- Since these errors and shifts have been observed by VIIRS, they indicate alignment errors in both on-board star trackers.

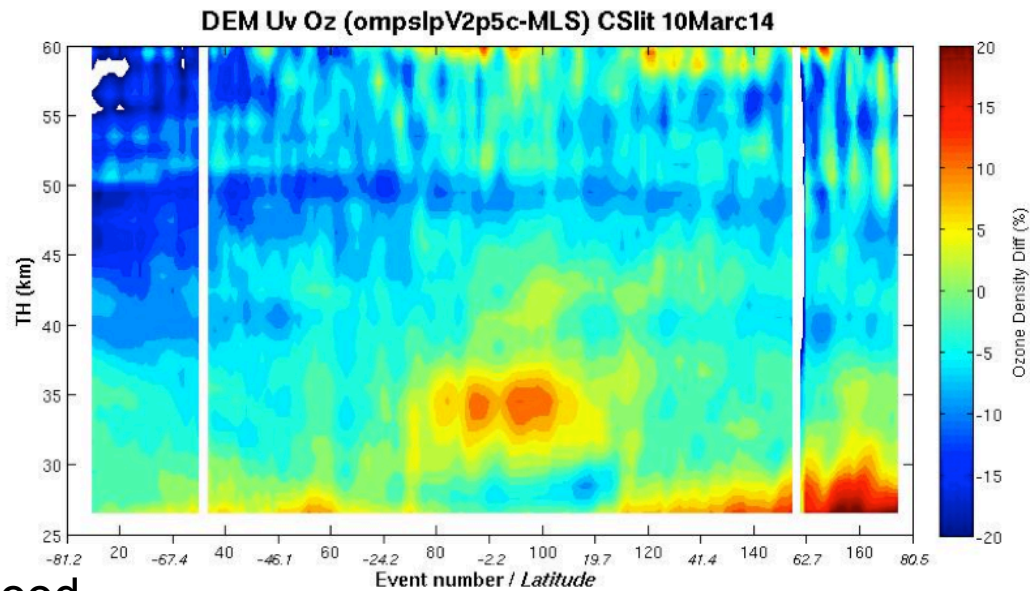


O_3 error due to aerosols estimated using SAGE climatology



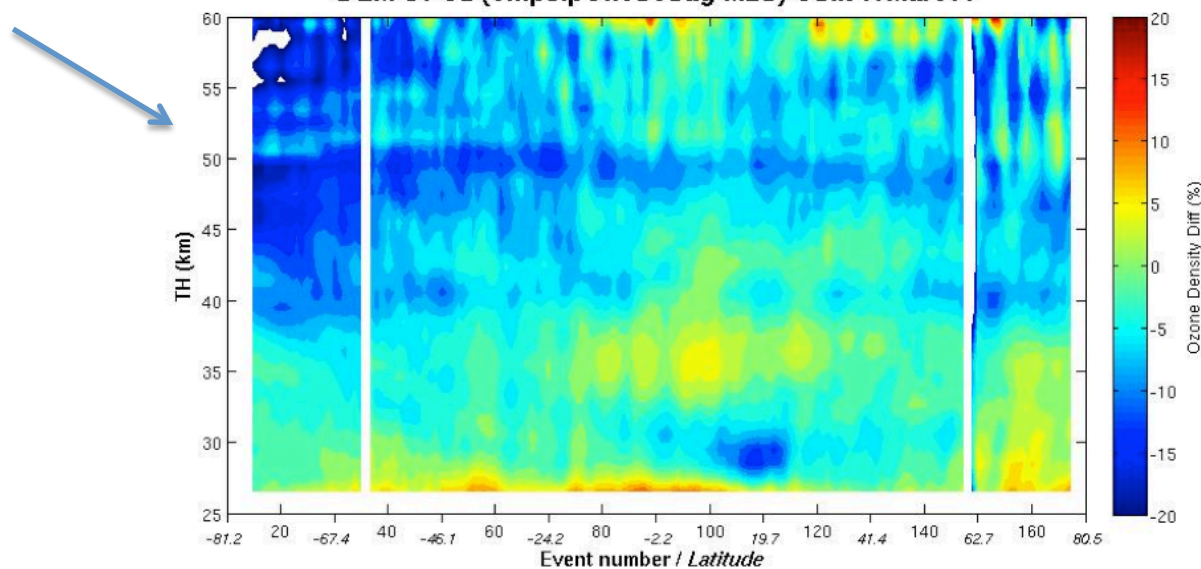
A simple aerosol retrieval method based on Chahine's non-linear relaxation method has been developed.

LP/UV-MLS with and without aerosol correction



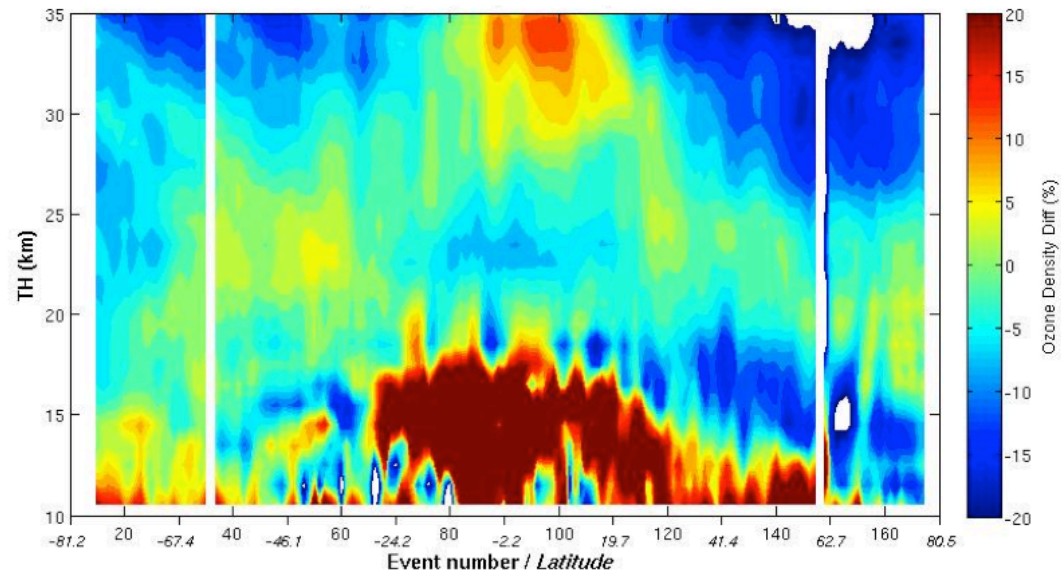
No correction

Bias not understood

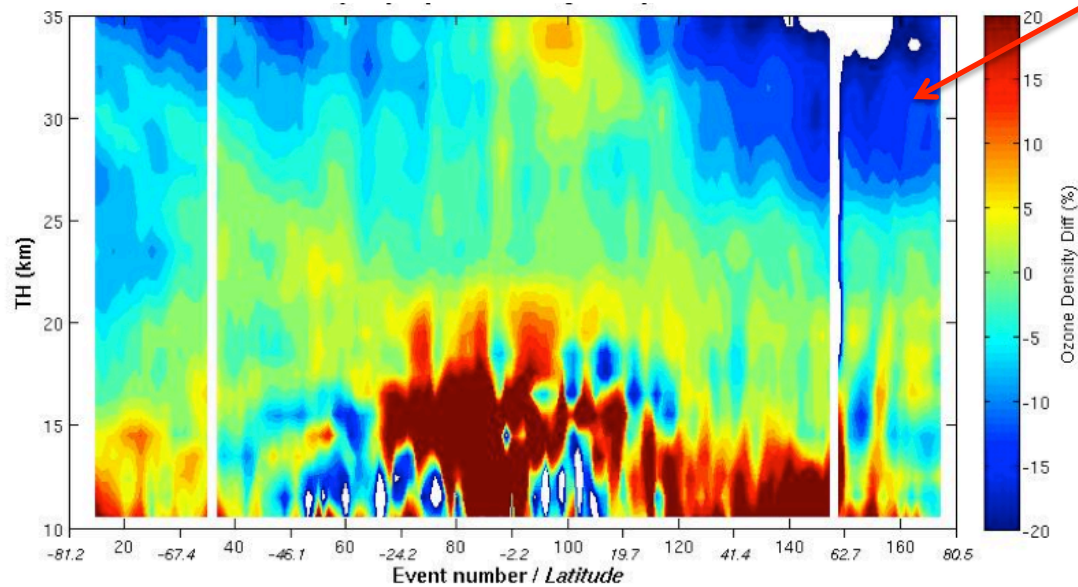


With correction

LP/VIS-MLS with and without aerosol correction



No correction



Bias not understood

With correction

Summary of Known Errors in V2 O₃ data

- There are complicated altitude registration errors in the data, but they have now been well characterized.
 - Caused by static and dynamic errors in S/C attitude, and errors in alignment and thermal shifts of 6 LP slits.
- Aerosol-caused errors are relatively small.
 - A simple method to estimate aerosol profiles, adequate to correct O₃ profiles, has been developed.

Unresolved L1b Issue

- Straylight error at VIS wavelengths is too large. It varies with altitude, wavelength and latitude.
 - A proposed solution is to force measured radiances to be no less than calculated (assuming no aerosols).
- O_3 from the 3 VIS slits have biases that vary with latitude and altitude, even after TH correction.
 - A proposed solution is to compare zonally averaged radiances and remove the biases empirically.

Near-term L2 Plans

- Create a new aerosol dataset
 - Assume fixed size distribution, independent of latitude/altitude/time.
 - Retrieve profiles using Chahine's NLR method
- Create a dataset of cirrus/PSC heights
 - Compare with CALIOP
- Correct GMAO P/T profiles above 40 km
 - Using 350 nm radiances normalized @ 40 km.
 - Validate using SABER/MIPAS